DOCUMENT RESUME

ED 197 993 SE 034 171

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| TITLE | Field Keys to Common Hawaiian Marine Animals and Plants. |
| INSTITUTION | Hawaii State Dept. of Education, Honolulu. Office of Instructional Services. |
| REPORT NO | RS-78-5247 |
| PUB DATE | Mar 78 |
| NOTE | 74p.: Not available in hard copy due to colored pages throughout entire document. |
| EDRS PRICE | MF01 Plus Postage. PC Not Available from EDRS. |
| DESCRIPTORS | *Animals; Biology; Elementary Secondary Education; Environmental Education; *Field Trips; *Marine Biology; Outdoor Education; *Plant Identification; Science Education |
| IDENTIFIERS | Hawaii |

ABSTRACT

Presented are keys for identifying common Hawaiian marine algae, beach plants, reef corals, sea urchins, tidepool fishes, and sea cucumbers. Nearly all species considered can be distinguished by characteristics visible to the naked eye. Line drawings illustrate most plants and animals included, and a list of suggested readings follows each section. (WB)

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# Field Keys to Common Hawaiian Marine Animals and Plants

Office of Instructional Services/General Education Branch
Department of Education □ State of Hawaii □ RS 78-5247 □ March 1978

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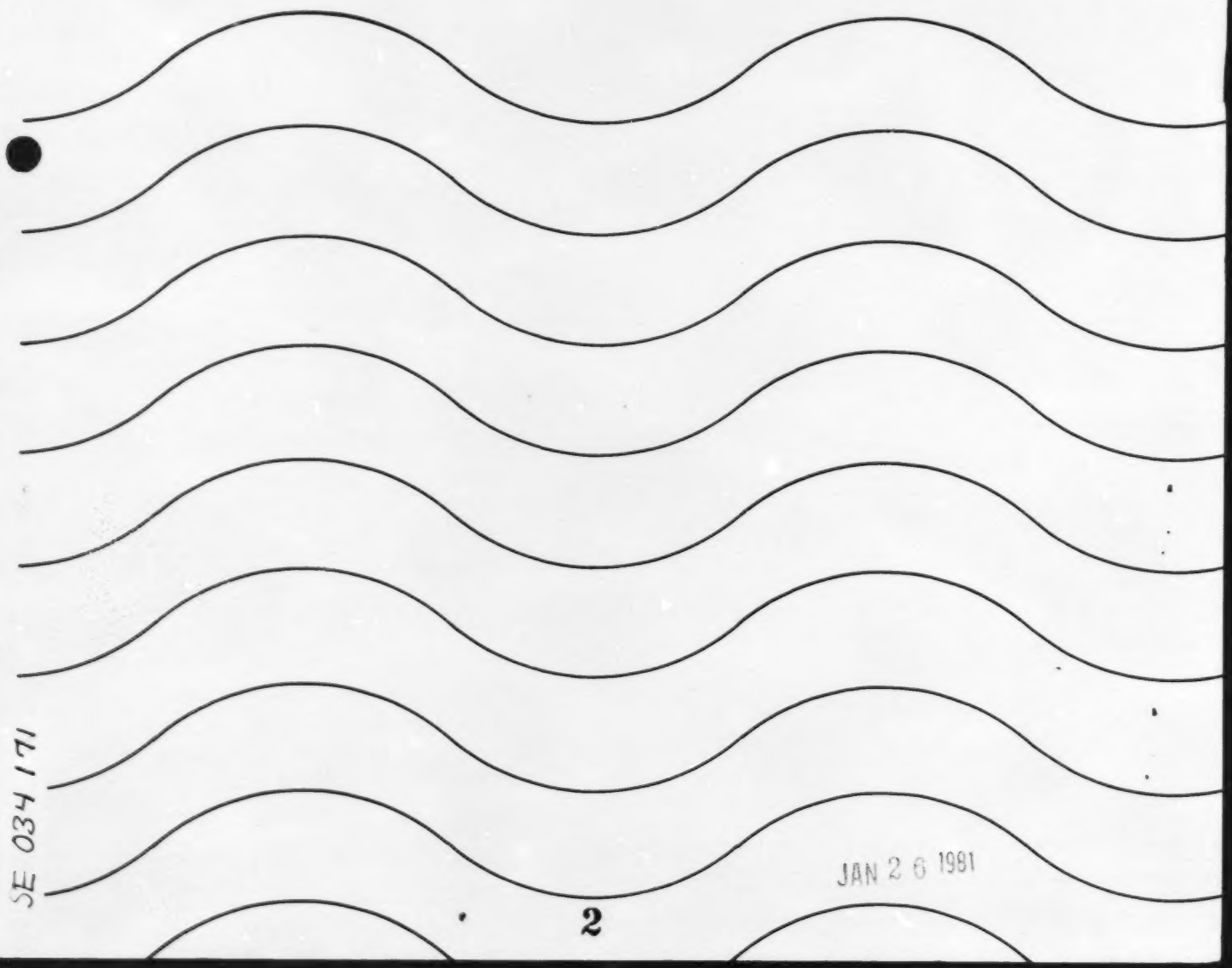

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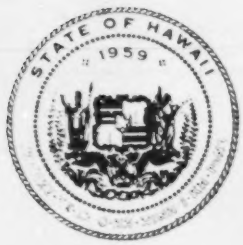


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# FOREWORD

During recent years, there has been a growing interest in the marine environment and the problems and prospects inherent in that environment. The Third United Nations Conference on the Law of the Sea initiated in 1973, the Coastal Zone Management Act of 1972, and the creation of a Marine Affairs Coordinator position in our State in 1970 are but a few of the many efforts that attest to the increasing emphasis placed on the marine environment at global, national, and state levels.

This growing interest and awareness of the marine environment has spread to the public schools of Hawaii, resulting in increasing numbers of marine education classes at the secondary level and more marine units being studied at the elementary level. Often these marine studies involve trips to observe marine environments directly. During these trips to reef and beach areas, problems involving identification of local flora and fauna may emerge.

This set of identification keys has been developed to aid students and teachers in identifying the local flora and fauna. These keys are unique in that they were developed by students and teachers from schools in Hawaii, aided by University of Hawaii personnel. The arrangement and organization of the keys is the product of the group's effort to simplify identification of common marine plants and animals.

It is hoped that this set of identification keys will help the students and teachers of the schools of Hawaii to develop a better understanding of and appreciation for our marine environment.

Charles G. Clark, Superintendent

# Acknowledgments

These keys were developed during the 1977 Marine Summer Science Training Program, sponsored by the National Science Foundation, Grant #SM-177-000-680, under the direction of the Curriculum Research and Development Group and the Waikiki Aquarium of the University of Hawaii.

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# FIELD KEYS TO COMMON HAWAIIAN ANIMALS AND PLANTS

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6-A

# COMMON SEAWEEDS

## How to Use the Key

A. Examine and familiarize yourself with your specimen. Note its color, size, texture and any other outstanding features.

B. The key to green algae (in the Pictorial Key for Common Hawaiian Seaweeds) will be used as an example in this explanation. Use the first number on the left when you are told to "go to #__" in the explanation that follows.

C. Start at #1 (Green Algae, second page of key). There are two descriptions of green algae. Read both and decide which fits your specimen. In this example we will suppose it fits the first description (it is a calcareous plant as determined by the acid/bubble test). Note the number to the right of this description. In this case, it is the numeral 2, so go on to #2. Next to the number 2 is the number (1) followed by the terms, cigar-shaped, sectioned and branching, and umbrella-like. (The number in the parenthesis always indicates the description you came from; i.e. you came from the number (1) to 2 - it tells you how you got where you are and where you have been.)

D. Read the descriptions at #2 (cigar-shaped, sectioned and branching, umbrella-like). Decide which fits your plants, and note its genus. In this case, your specimen is cigar-shaped, so it is of the genus Neomeris. You have now keyed out one sample and can go on to another.

E. Again, start at the beginning of the key at #1. This time your plant is not calcareous, so go on to #3.

F. Read the descriptions at #3. Your algae is branching, so go to #5.

G. The branches of your specimen develop from a single holdfast, not a runner, so go on to #6.

H. Since your algae had flat branches and is lettuce-like, skip to #11.

I. At #11, there is only one choice, so your plant is of the genus Ulva. Examine the drawings and decide whether your particular Ulva is one of the species shown. ("400X" means magnified 400 times; "1X" means magnified one time, or life size.)

## NOTE

Most of the local species can be identified by their external morphology and their color. Some limu are hard to key, therefore, cross-section preparations are necessary. Cross-sections of algal blades or stipes can be easily cut using a razor blade. Place a piece of alga on a slide and hold it with your forefinger placed at a 45° angle to the slide. As you cut cross-sections with the razor blade, let your finger descend to lie flat on the slide. This movement will push the alga forward as you cut. Cut a dozen sections as thinly as you can. Put a few drops of water on the slide to float the cross-sections away from each other. Put a cover slip over the slide and move it gently up and down to further separate the cross-sections. Examine the sections under a microscope.

## KEY TO THE MARINE PLANTS

1. Marine flowering plant.....Halophilia
   Marine algae.....2

Halophilia

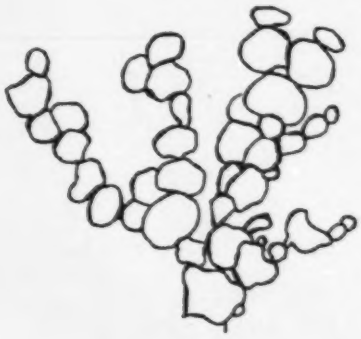
2(1) Plant green.....Green Algae.....pg. A-5
   Plant brown, sometimes with olive, greenish or yellowish casts but without pink tinges.....Brown Algae.....pg. A-10
   Plant pink or red (including Acanthophora which is brown in color).....Red Algae.....pg. A-15
   Plant hairlike, dark green or blackish.....Blue-Green Algae....pg. A-23

## GREEN ALGAE

1. Plants calcareous (a crushed piece will bubble if placed in a drop of 6 normal HCL).....2
   Plants not calcareous (does not bubble).....3

2(1) Cigar-shaped.....Neomeris
   Sectioned and branching.....Halimeda
   Umbrella-like.....Acetabularia

Neomeris 10X

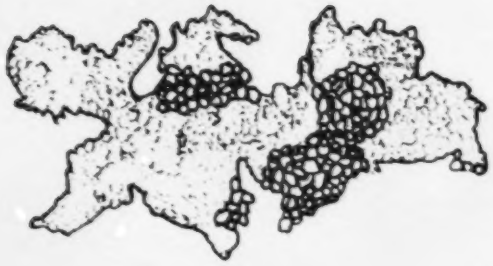


Halimeda 1X

Acetabularia 6X

3(1) Plants bubble-like.....4
   Plants branching.....5

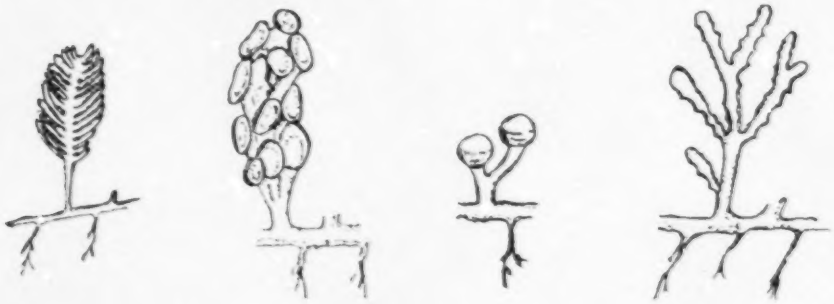
4(3) Mass of bubbles.....Dictyosphaeria
   Small single bubbles with internal stringlike supports.....Bornatella



Dictyosphaeria 1X

Bornatella 3X

5(3) Branches arise from runner (rhizome).....Caulerpa
Branches develop from a single holdfast, not a runner.....6



Caulerpa spp. 2X

X-section 400X

6(5) Branches hollow in cross section.....7
Branches flat, lettuce-like (X-section 2 cells thick).....11

7(6) Bubbles in blades or branches.....8
No bubbles in blades or branches.....9

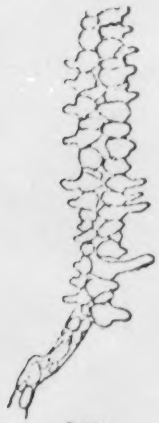
8(7) Occasional bubbles, smooth blade margins.....Enteromorpha
Bubbles in each blade, margins irregular.....Siphonocladus

Enteromorpha 1X

X-section 100X

11

1X



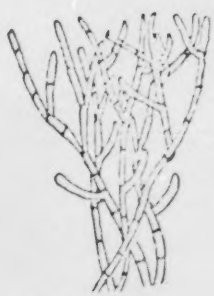
10X

Siphonocladus

9(7) Plants not hairlike and in dense clumps or mats.....Valonia, Cladophoropsis, Microdictyon, Codium

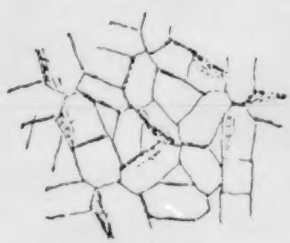
Plants hairlike.....10

Valonia 2X



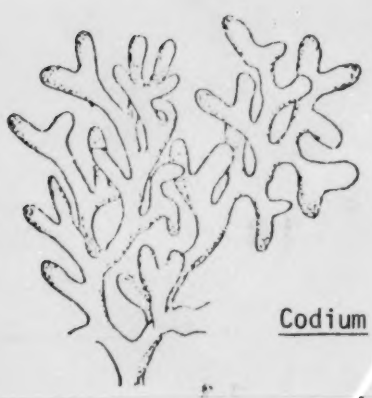
Cladophoropsis 2X

1X



100X

Microdictyon

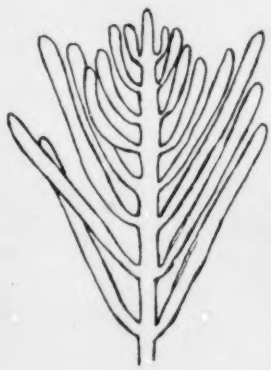


Codium 1X

"Squash Prep" 400X

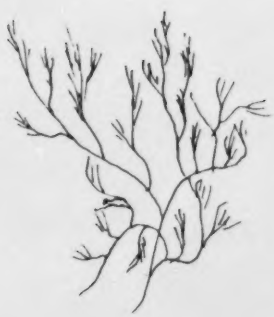
10(9) Non-septate branches.....Bryopsis
Septate Branches.....Cladophora

1X

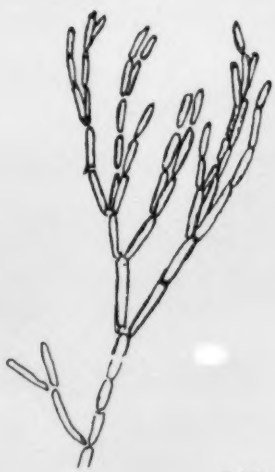


10X

Bryopsis



1X

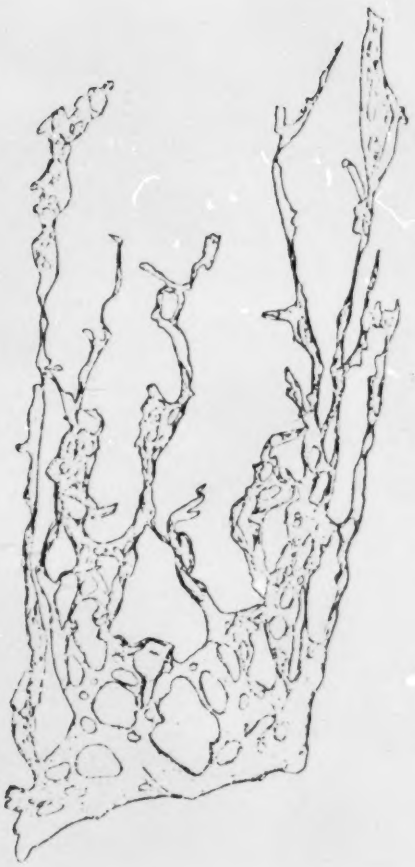


10X

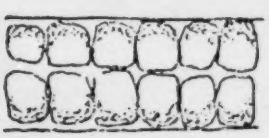
Cladophora

**13**

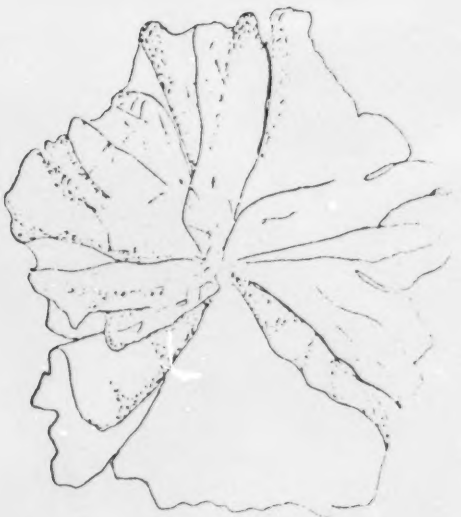
11(6) Branches flat, lettuce-like
(X-section 2 cells thick).....Ulva



Ulva reticulata 1X



X-section 400X



Ulva lactuca 1X

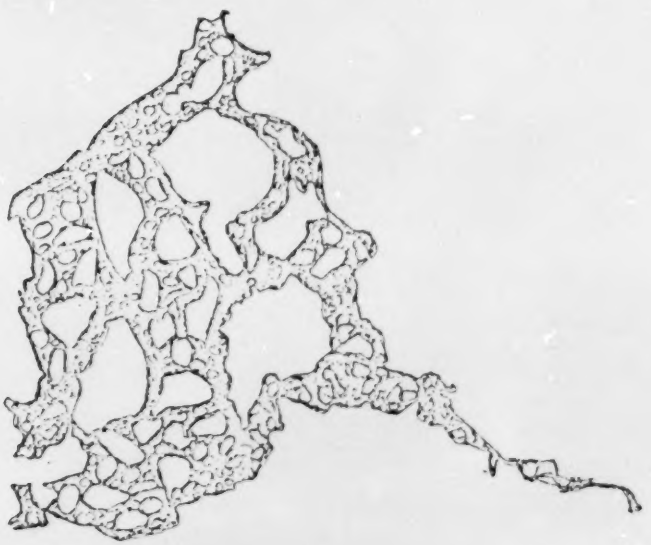
Ulva fasciata 1X

## BROWN ALGAE

Plants clearly brown, sometimes with olive or greenish or yellowish casts but without any pink tinges.

1 Plants resemble hollow lumps.....2
Plants not lump-like hollow masses.....3

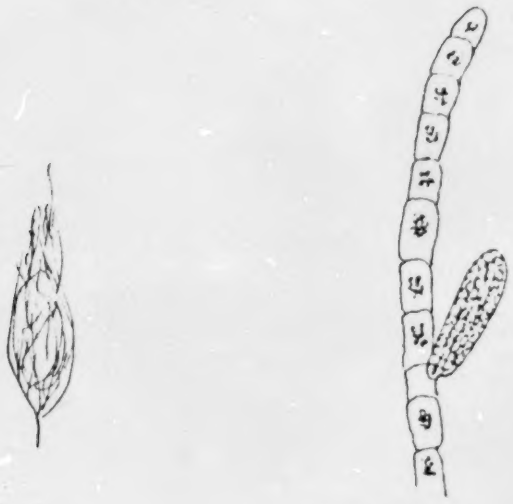
2(1) Plants look like a piece of brown swiss cheese.....Hydroclathus
Plants look like brown lumpy bubble without holes.....Colpomenia



Hydroclathrus 1X

Colpomenia 1X

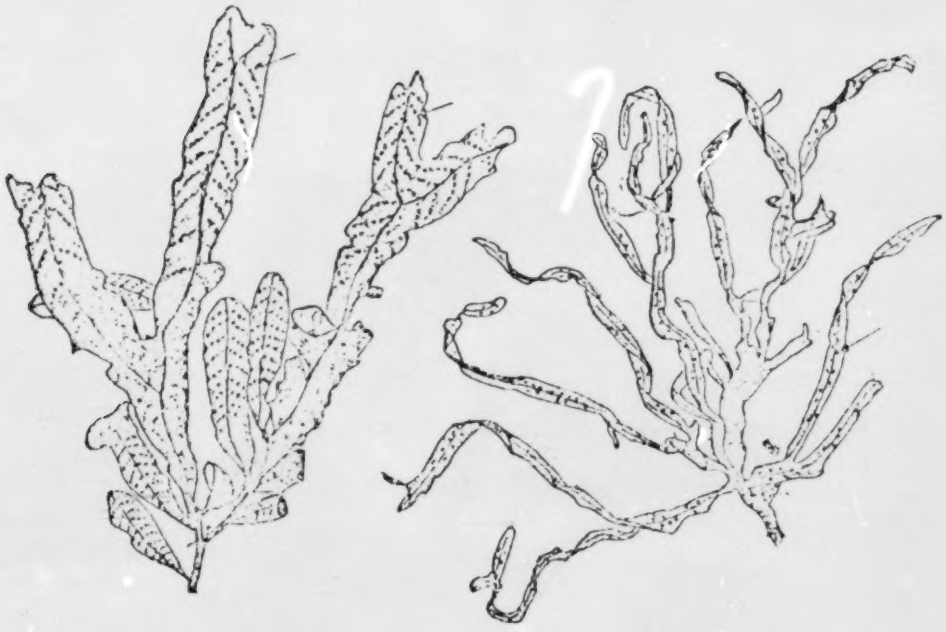
3(1) Plant hairlike.....Ectocarpus
Plant not hairlike, blades flat.....4



1X 100X

Ectocarpus

4(3) Blades with mid-ribs.....Dictyopterus
Blades lacking mid-ribs.....5

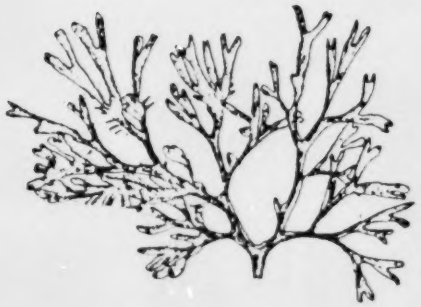


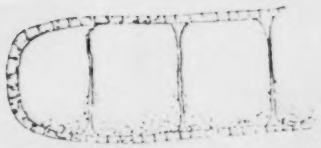
Dictyopteris australis 1X Dictyopteris plagiogramma 1X

5(4) Plant with no stem running its length.....6
Plant with a distinct stem running its length.....7

6(5) Blade with Y-shaped tips.....Dictyota
Blade fanlike, calcareous.....Padina
Blade with small dark bumps.....Spatoglossum

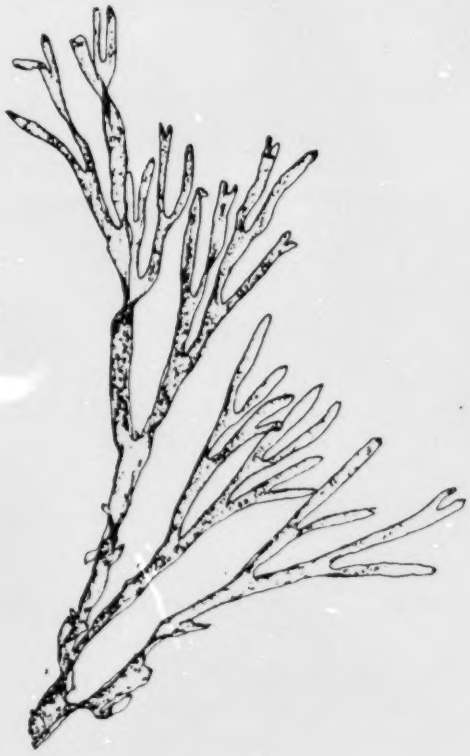
1X





X-section 100X

1X



1X

Dictyota spp.

Padina 1X

Spatoglossum 1X

7(5) Blade umbrella-like with rough edges.....Turbinaria
Blade flat, plant often with berry-like floats.....Sargassum

Turbinaria 1X

Sargassum echinocarpum 1X

Sargassum obtusifolium 1X

Sargassum polyphyllum 1X

## RED ALGAE

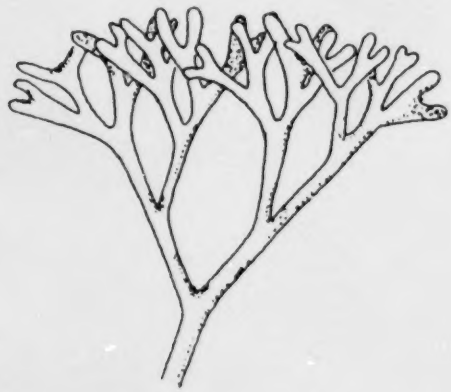
| | | |
|---|---|---|
| 1 | Plant gelatinous and slimy | 2 |
| | Plant not slimy | 3 |
| 2(1) | Branches and blades roundish | Trichoglea |
| | Blades flat | Halymenia |

Trichoglea 1X

Halymenia 1X

3(1) Plant partially (pliable), or completely calcified (stiff); bubbles when placed in acid.....4
Plant not calcified.....7

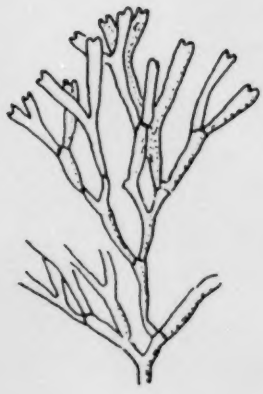
4(3) Plant non-segmented.....Gymnogongrus
Plant segmented.....5



Gymnogongrus 1X

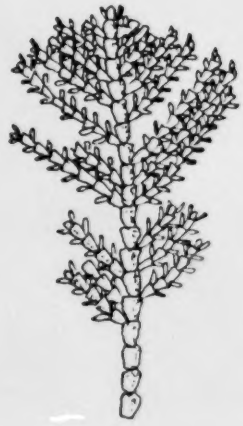
5(4) Tip of each branch with depression.....Galaxaura
Tips lack depressions.....6

6(5) Branching is dichotomous.....Jania
Branching is pinnate.....Corallina



Galaxaura 2X

Jania 20X

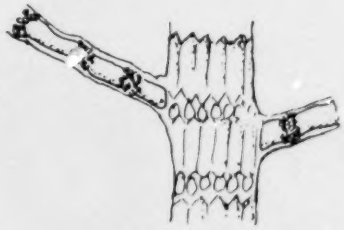


Corallina 2X

7(3) Plants cylindrical in cross section.....8
Plants not cylindrical in cross section.....17

8(7) Plants with reddish band alternating with light band...9
Plants without bands.....11

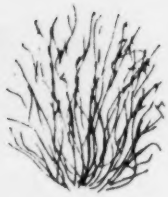
9(8) Plants not hairlike, red bands only on branches.....Spyridia
Plants hairlike, red bands on both stems and branches..10



Spyridia 40X

10(9) Plant with whorls of 2 celled spines at regular intervals on stem.....Centroceras
Plant lacking whorls of 2 celled spines at regular intervals on stem.....Ceramium

Centroceras 40X



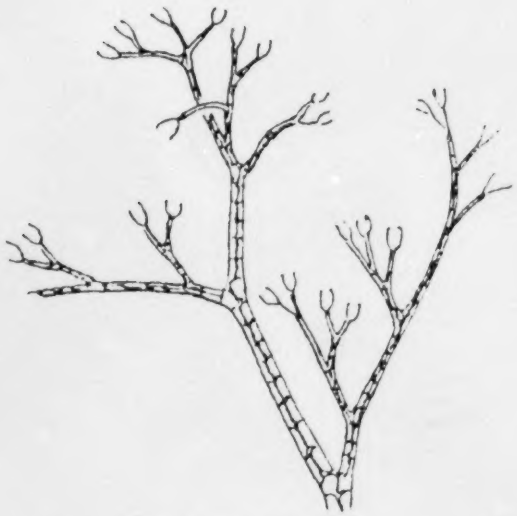
1X

40X

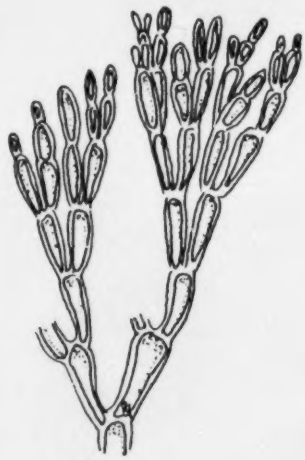
Ceramium

11(8) Plant hairlike.....12
Plant not hairlike.....13

12(11) Plant made up of tiers of elongated cells of approximately equal length.....Polysiphonia
Plant not as above.....Griffithsia



Polysiphonia 20X



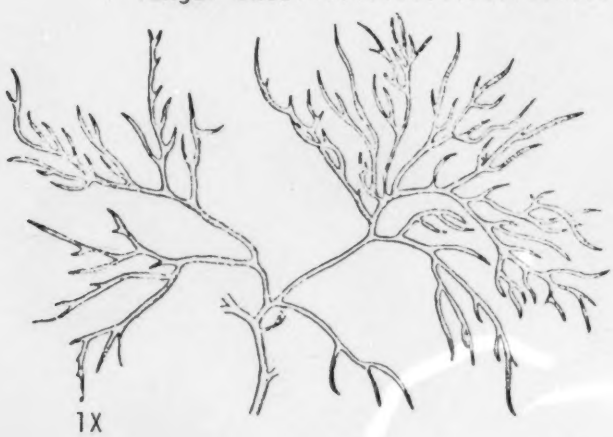
Griffithsia 20X

13(11) Plant with sunken pits at tips of branches.....Laurencia
Plant without sunken pits at tips.....14

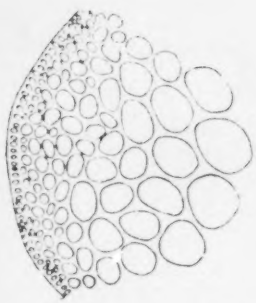
Laurencia 2X

14(13) Plant with branch tips tapered to a point.....15
Plant not as above.....16

15(14) Plant with very few short branches.....Gracilaria
Plant with many shortened branches between longer ones.....Hypnea

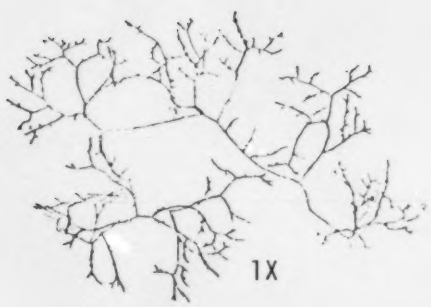


1X



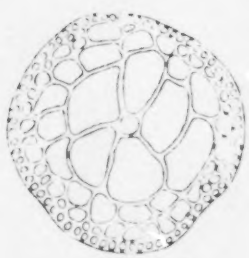
200X

Gracilaria



1X

20X



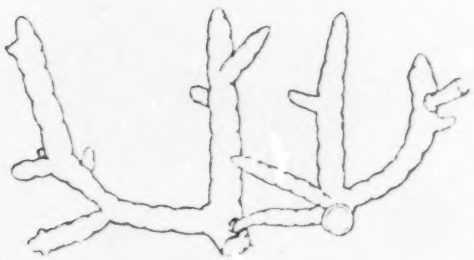
200X

Hypnea

16(14) Plant is prickly.....Acanthophora
Plant externally constricted.....Champia
Plant vertically branching off rhizome.....Asparagopsis
Plant wiry and rigid.....Ahnfeltia

Acanthophora 1X

3X



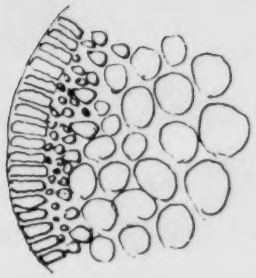
Champia 4X

1X

Asparagopsis

400X

1X



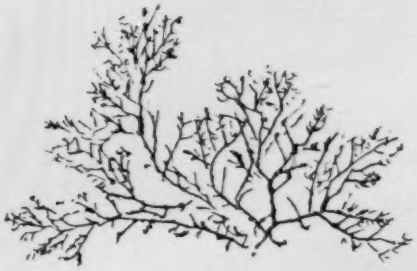
400X

Ahnfeltia

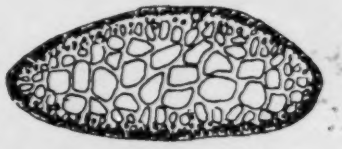
17(7) Plant blades with ragged margins.....18
Plant blades with smooth margins.....19

18(17) Plant with blades less than 2 mm wide with recurved tips.....Desmia
Plant with blades of over 3-4 mm wide, no recurved tips.....Amansia

20X



1X



X-section 100X

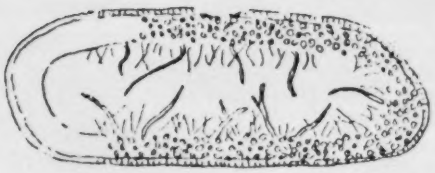
Desmia

1X

100X

Amansia

19(17) Cross section with semi-hollow interior.....Grateloupia
Cross section compact.....20



X-section 100X

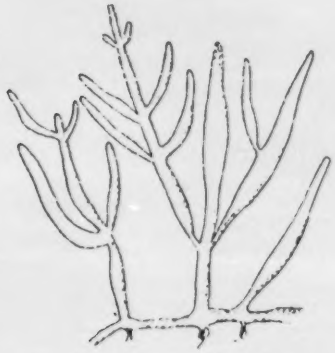
1X

Grateloupia

20(19) Cross section with small "cells" in center.....Gelidium
Cross section without small "cells" in center.....Pterocladia

X-section 100X: A typical X-section of Gelidium stem, with the smaller "cells" packed in among the larger tissues. (A) Small "cells" in outer part. (B) Small "cells" in inner part.

Gelidium



Pterocladia 20X

## BLUE-GREEN ALGAE

Hairlike algae; epiphytic or attached

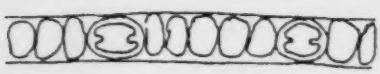
Black to dark brown.....Lyngbya
Greenish spots with white and grey.....Nostoc

1X

400X

Lyngbya

1X



400X

Nostoc

## SEAWEED RECIPES

Most of the Hawaiian limu are edible, except the calcium carbonate containing types. Local preferences are based on texture, taste, and availability. The recipes are basically "pickling" procedures. Boiling water is used to clean, bleach, and remove the bitter taste. (Very few limu species require this). Boiling also softens the limu. The boiling time is left to the cook.

1. Kim Chee Ogo (Korean Style)

The Hawaiian name for this limu is MANAUEA. The scientific name is Gracilaria.

1 lb. ogo
1/2 cup shoyu
1/4 cup vinegar
1 Tbsp. mirin
Ginger, grated (add to taste)
Chili pepper, grated (add to taste)
Garlic, chopped fine (add to taste)

Clean ogo, and if necessary, boil the ogo for a short time in a pot. Mix the seasonings and add to the boiled ogo. May be bottled and kept in the refrigerator.

2. Kailua Ogo

1/2 cup red wine-vinegar
1 lb. ogo
1 tsp. sugar
1 tsp. chives (diced green oinons)
1/4 diced tomato
Hot sauce to taste

Follow the same directions as in the above recipe for Kim Chee Ogo.

3. Pickled Codium

The Hawaiian name for this limu is A'ALA'ULA or WAWAE'IOLE

1/2 lb. Codium
1/2 cup wine-vinegar
1/2 tsp. sugar
1/4 diced tomato

Add sauce to cleaned (using only cold water) Codium immediately before serving. Codium toughens rapidly in the sauce. Better still, try using the sauce as a "dip".

4. Limu Tsukudani: (Use on hot rice dishes)

1 lb. ogo
1 1/4 cup brown sugar
1/2 cup mirin
1 1/4 cup shoyu
1/4 tsp. MSG

Clean limu. Bring sugar, shoyu, and mirin to a full boil. Place cleaned limu into pan and cover with sauce, and cook to a "mush" (Be careful that it doesn't burn; stir frequently). Goma (sesame seeds) and chili pepper may be added to taste.

## SUGGESTED READINGS


| | | |
|---|---|---|
| Arnold, A.F. | 1968 | The Sea-Beach at Ebb Tide. Dover Publications, Inc., New York. |
| Daws, D.J. | 1967 | Marine Algae in the Vicinity of Tampa Bay, Florida. University of South Florida |
| Dawson, E.Y. | 1956 | How to Know the Seaweeds. Wm. C. Brown Co. |
| | 1966 | Marine Botany: An Introduction. Holt, Rinehart, Inc. |
| Fritsch, F.E. | 1935 | Structure and Reproduction of the Algae. Cambridge University Press |
| Littler, M.M. | 1971 | Roles of Hawaiian Crustose Coralline Algae (Rhodophyta) In Reef Biology. PhD Thesis, University of Hawaii. |
| Neal, M.C. | 1930 | Hawaiian Marine Algae. Bishop Museum Bull. 67 |
| Reed, M. | 1907 | The Economic Seaweeds of Hawaii and their Food Value. Annual Report of the Hawaii Agricultural Experiment Station for 1906. |

# COMMON BEACH PLANTS

## How to Use the Key

A. Visually examine your specimen and familiarize yourself with its characteristics. Notice particularly the shape and color of the flowers, the shape, size and arrangement of the leaves, type of fruits, and type and size of stems.

B. Decide whether your specimen is a tree, shrub, grass, or herb. Turn to that section in the key.

C. Match the characteristics of your specimen with the descriptions and sketches provided in the key.

# COMMON BEACH PLANTS OF HAWAII

## NOTE

The plants in this section are the common trees, shrubs, grasses and herbs found on the beaches of Hawaii. Beach plants are an important part of each marine field trip because of their obvious anatomical adaptations to stress and because of their potential as a food source. Unlike most marine animals, plants are hardy, readily available, and their anatomical adaptations are easily seen.

Many beach plants are eaten, sometimes to diversify diets and sometimes to supplement diets. Local examples of edible beach plants are Batis and Milo leaves.

GRASSES AND HERBS

Capriola dactylon

(BERMUDA GRASS) ——→

Flowers: greenish-white

Heliotropium anomalum

(HINAHINA) ——→

Flowers: pale blue

Leaves: silvery green

Lycium sandwicense

(OHELO KAI or AEAE)

Flowers: white, pink, or lilac

Succulent

Batis maritima

(BATIS or AKULI KULI KAI)

Flowers: yellowish-green

Succulent

Ipomoea pes-caprae

(BEACH MORNING GLORY or POHUEHUE)

Flowers: pink

Species similar in appearance:

Jacquemontia sandwicensis

(PAUOHIIAKA) blue flowers

Ipomoea acetosaefolia

(HUNAKAI) white flowers

36

Sida cordifolia

(LEI ILIMA)

Flowers: orange

Species similar in appearance:

Sida fallax

(ILIMA)

SHRUBS WITH SIMPLE LEAVES

Pluchea indica

(PLUCHEA)

Flowers: purple

Scaevola lobelia

(NAUPAKA)

Flowers: white, half-formed

SHRUBS WITH BIPINNATE LEAVES

38

Pod-like fruits for each species. (natural size)

Desmanthus virgatus

(DESMANTHUS)

Flowers: white

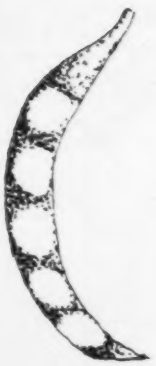
Stems: less than 5 mm wide

Leucaena glauca

(KOA HAOLE)

Flowers: white

Stem: more than 5 mm wide

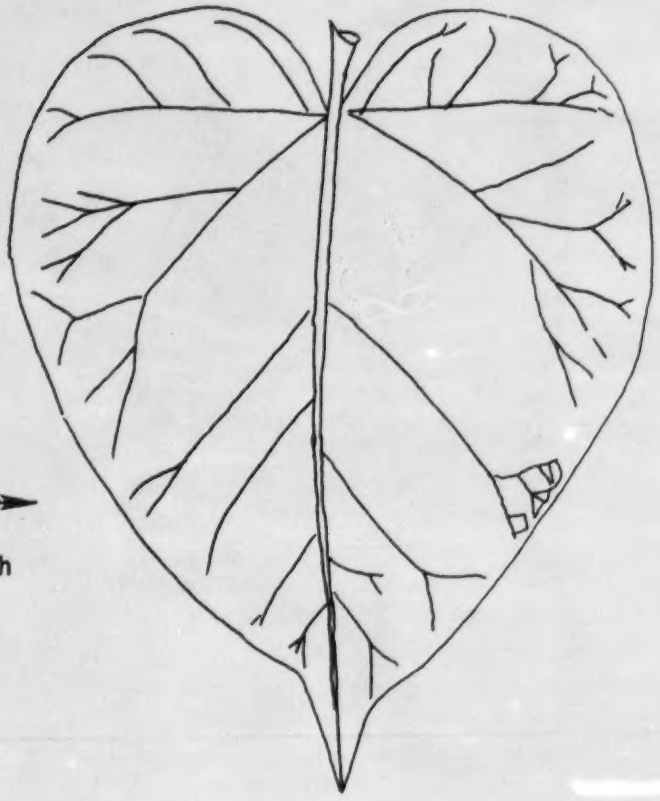


Acacia farnesiana

(KLU BUSH)

Flowers: yellow

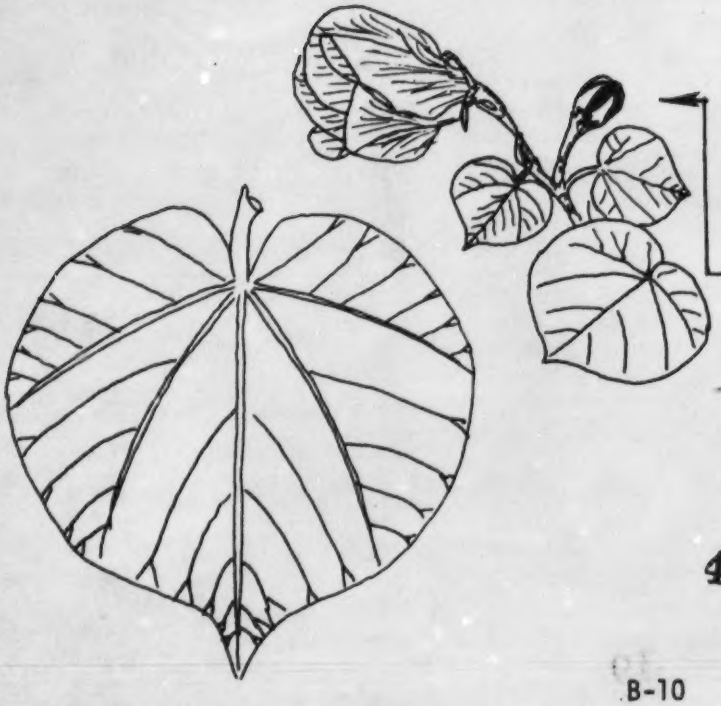
Stem: with sharp spines



Thespesia populnea

(MILO)

Flowers: pale yellow with purple centers



Hibiscus tiliaceus

(HAU)

Flowers: yellow with dark centers

Terminalia catappa

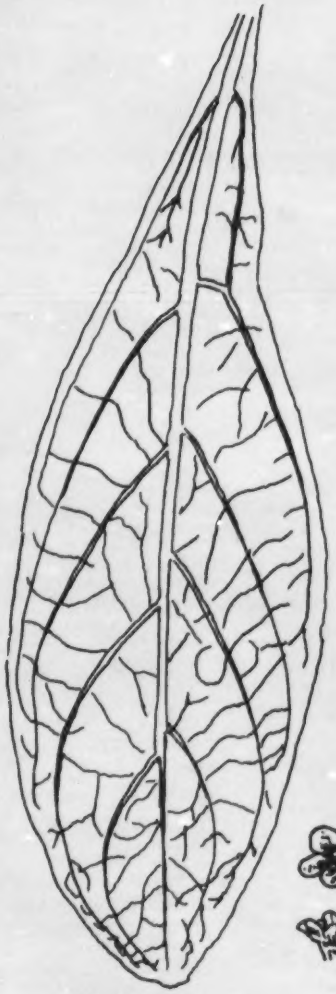
(FALSE KAMANI)

Flowers: white

Leaves: green/red

a-fruit in cross section

b-fruit, side view



Messerschmidia argentea

(TREE HELIOTROPE)

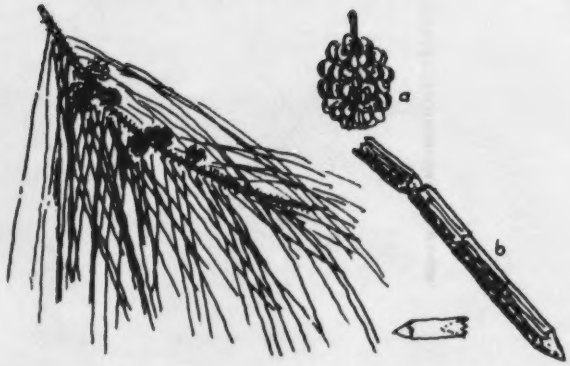
Flowers: white

Leaves: silky-hairy

Casuarina equisetifolia

(COMMON IRONWOOD)

a. fruit (natural size)
b. leaf (enlarged)



Rhizophora mangle

(AMERICAN MANGROVE)

Flowers: pale yellow

## SUGGESTED READINGS

After this section was completed, a booklet of color photos entitled Hawaiian Coastal Plants and Scenic Shorelines by M.D. Merlin was published. This is a valuable addition to beach plant identification. The following books and pamphlets are also helpful in identification and utilization of these plants.


| | | |
|---|---|---|
| Anon. | 1943 | Emergency Food Plants and Poisonous Plants of the Islands of the Pacific. U.s. Govt. Print. Off., Washington, D.C., Tech. Manual #TM 10-420. |
| Gibbons, E. | 1967 | Beachcomber's Handbook. David McKay Co., Inc. |
| Haselwood, E., & G.G. Motter | 1976 | Handbook of Hawaiian Weeds. Lyon Arboretum. |
| Neal, M.C. | 1965 | In the Gardens of Hawaii. Bishop Museum Press. |
| Pope, W.T. | 1968 | Manual of Wayside Plants. Charles E. Tuttle Co. |

# COMMON
# REEF CORALS

## How to Use the Key

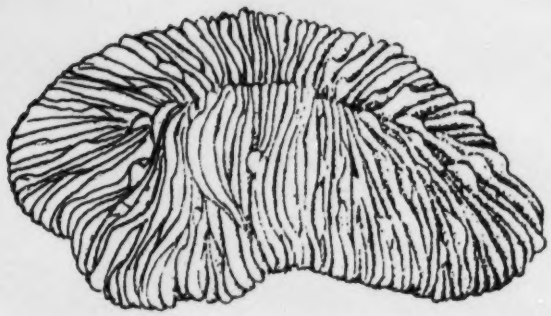
A. Visually examine your specimen and familiarize yourself with its characteristics.

B. Match the characteristics of your specimen with the descriptions and sketches provided in the key. Note: Color characteristics refer to living corals since dead reef coral skeletons are almost always white.

# COMMON REEF CORALS

Fungia scutaria

Color light to dark brown. Septa sharp. Upper surface flat to arched: undersurface concave. Solitary coral.

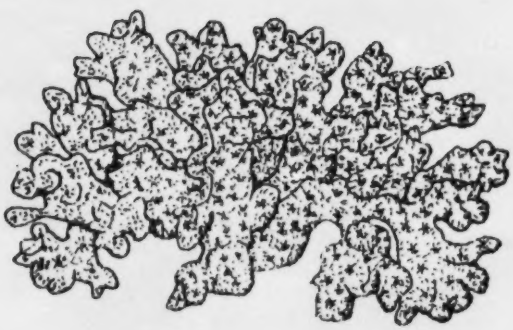


Pavona varians

Color tan to brown. Septa sharp and distinct. Meandering ridges steep. Calices crowded together in the valleys.

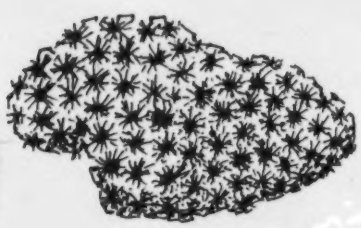
Psammacora stellata

Color pale brown with pale red and green patches. Branches stubby, angular, and irregular. Calices shallow.



Leptastrea purpurea

Color light brown or purple. Calices a network of fine inconspicuous hair-line grooves.

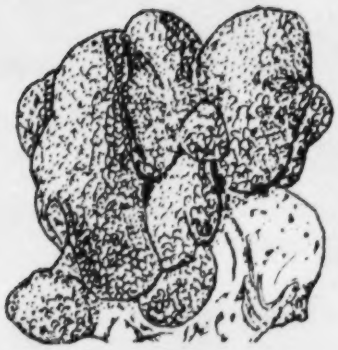


Porites compressa

Color brown or olive green. Lobes irregular and branch-like.

Porites lobata

Color yellow-green. Lobes rounded, sometimes tall, but never branch-like.



Pocillopora damicornis

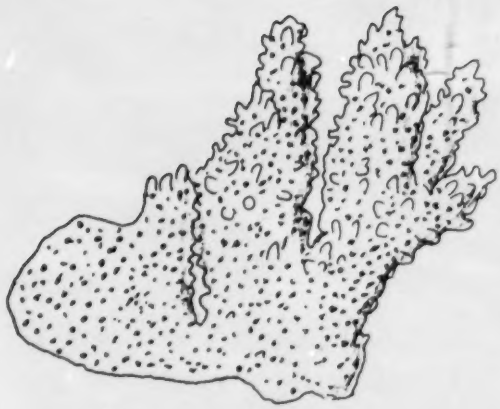
Color yellow-brown. Branches no thicker than a pencil. Sometimes short and stubby, more often long and slender.

Pocillopora meandrina

Color light brown or pink. Colony hemispherical. Branches flat, wide, tall and resemble thick leaves with their tips cut off. Width at top of branches frequently greater than at their base.

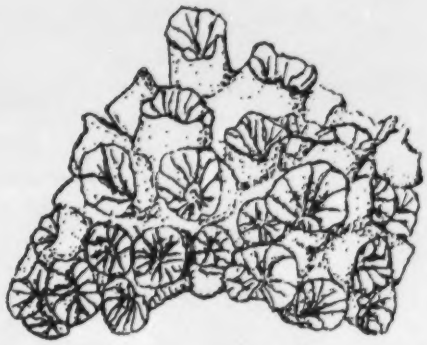
Montipora verrucosa

Color brown with white or pale blue projections. Nipple like projections next to each calyx. Corals similar in shape are: Montipora dilatata (blackish brown) and Montipora flabellata (light blue).



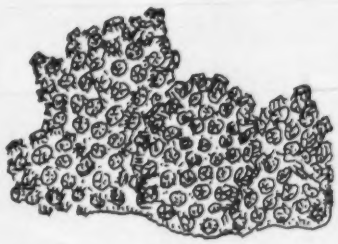
Tubastrea aurea

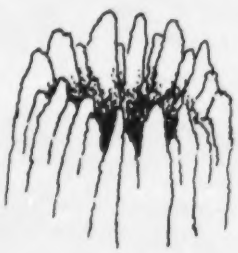
Color bright orange. Calices are large, greater than 1/4" in diameter.



Cyphastrea ocellina

Color dark brown to reddish brown. Calices crowded and point randomly in many directions. Calices are small and 1/16" in diameter; but with high jagged walls.





Leptastrea bottae

Color light brown, green, pink or yellow. Resembles Cyphastrea ocellina, but calices are larger and spaced farther apart. Calices are 1/8" to 1/4" in diameter and elevated.

## SUGGESTED READINGS


| | | |
|---|---|---|
| Devaney D.M. and Eldridge L.G. | 1977 | Reef and Shore Fauna of Hawaii, Sect 1., Protozoa through Ctenophora, B.P. Bishop Museum Special Publication 64 (1). |
| Arnold, A.F. | 1968 | The Sea-Beach at Ebb Tide. Dover Publications, Inc., New York. |
| Wallin, Doug | 1976 | Exotic Fishes & Corals of Hawaii & the Pacific. World Wide Distributors, Ltd. Honolulu, Hawaii. |
| Hobsson, E. and Chave E. | 1972 | Hawaii Reef Animals. The University Press of Hawaii. Honolulu, Hawaii. |
| Curriculum Research & Development Group Staff, University of Hawaii | 1976 | Reef and Shore. CRDG, University of Hawaii. Honolulu, Hawaii. |

# COMMON
# HERMIT CRABS

50

## How to Use the Key

A. Visually examine your specimen and familiarize yourself with its characteristics. Notice particularly the size of the claws in relation to each other and the color patterns of the claw and legs.

B. Look at the identification key beside #1. Choose the description which best fits your specimen. Note the number on the right side of the description that you have chosen.

C. Move down the key to find that number in the set of numbers on the left side of the page outside of the parentheses.

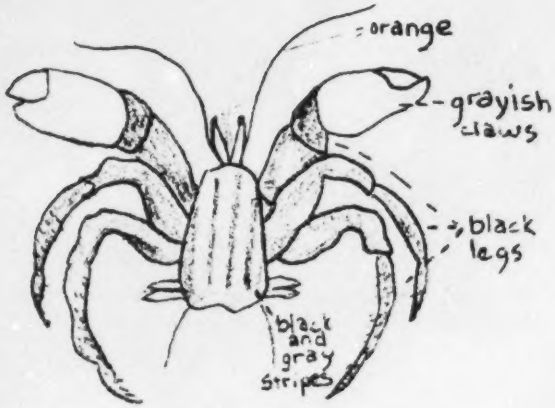
D. Choose the description which best fits your specimen. Note the number on the right side of the description if you have not identified your specimen.

E. Repeat Step C if necessary.

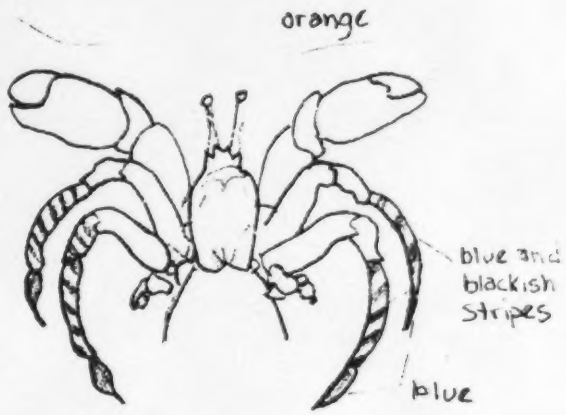
## KEY TO SIX COMMON HAWAIIAN SPECIES OF HERMIT CRABS

| | | |
|---|---|---|
| 1 | Claws of equal size..... | 2 |
| | Left claw larger than right claw..... | 3 |
| 2(1) | Hairy black legs..... | *Clibanarius corallinus* |
| | Striped legs..... | *Clibanarius zebra* |
| 3(1) | Legs banded..... | 4 |
| | Legs a solid color except at tips..... | 5 |
| 4(3) | Claws brownish with white tips..... | *Calcinus elegans* |
| | Claws grey with white tips..... | *Calcinus seurati* |
| 5(3) | Claws greenish-gray..... | *Calcinus latens* |
| | Claws brown with white tips..... | *Calcinus laevimanus* |

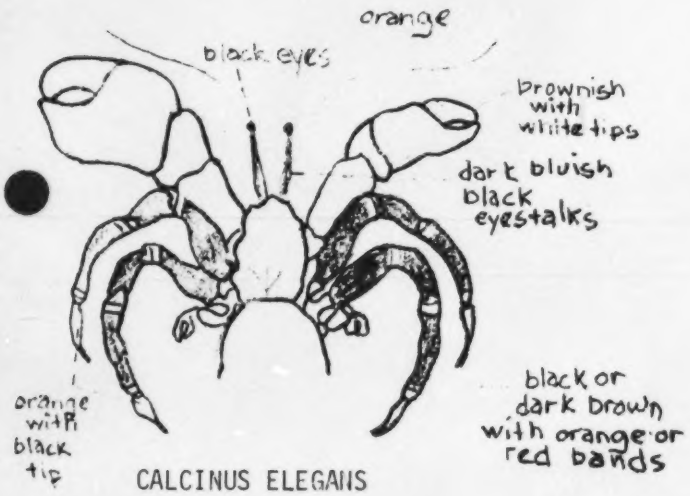
SIX COMMON HAWAIIAN SPECIES OF HERMIT CRABS (TOP VIEW)



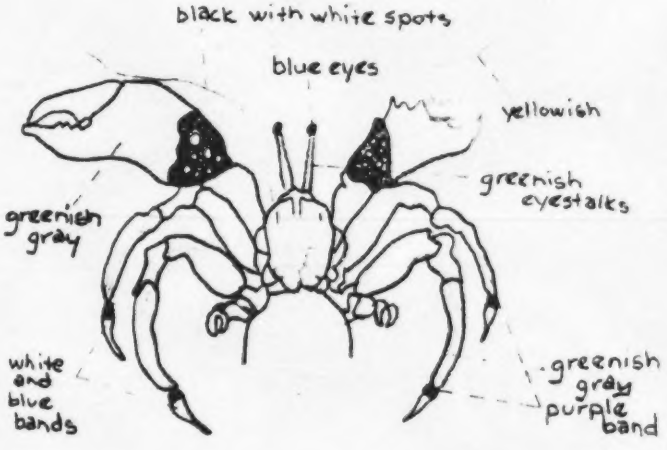

CLIBANARIUS CORALLINUS



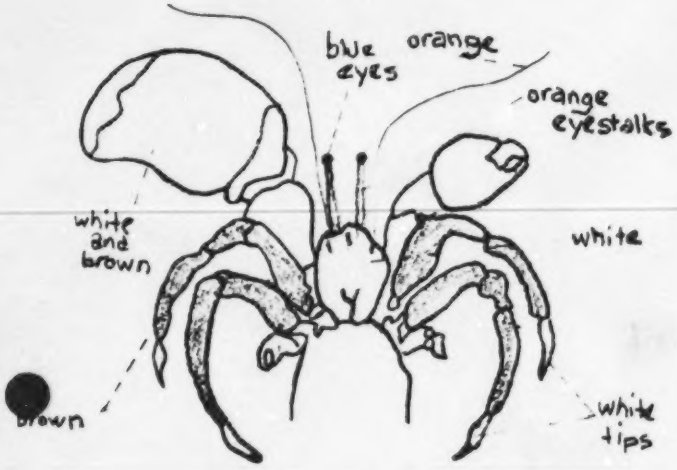

CLIBANARIUS ZEBRA


orange
black eyes
brownish with white tips
dark bluish black eyestalks
orange with black tip
black or dark brown with orange or red bands

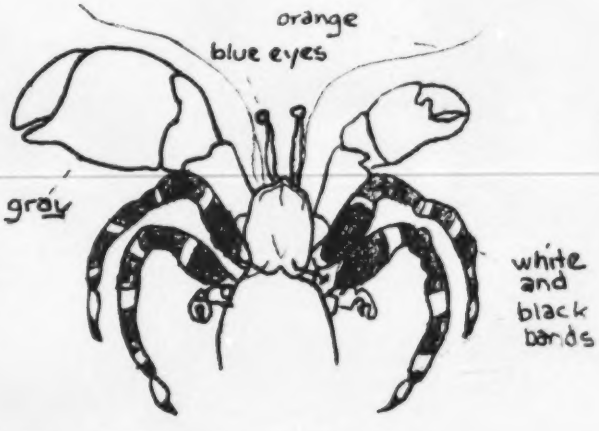
CALCINUS ELEGANS




CALCINUS LATENS




CALCINUS LAEVIMANUS




CALCINUS SEURATI

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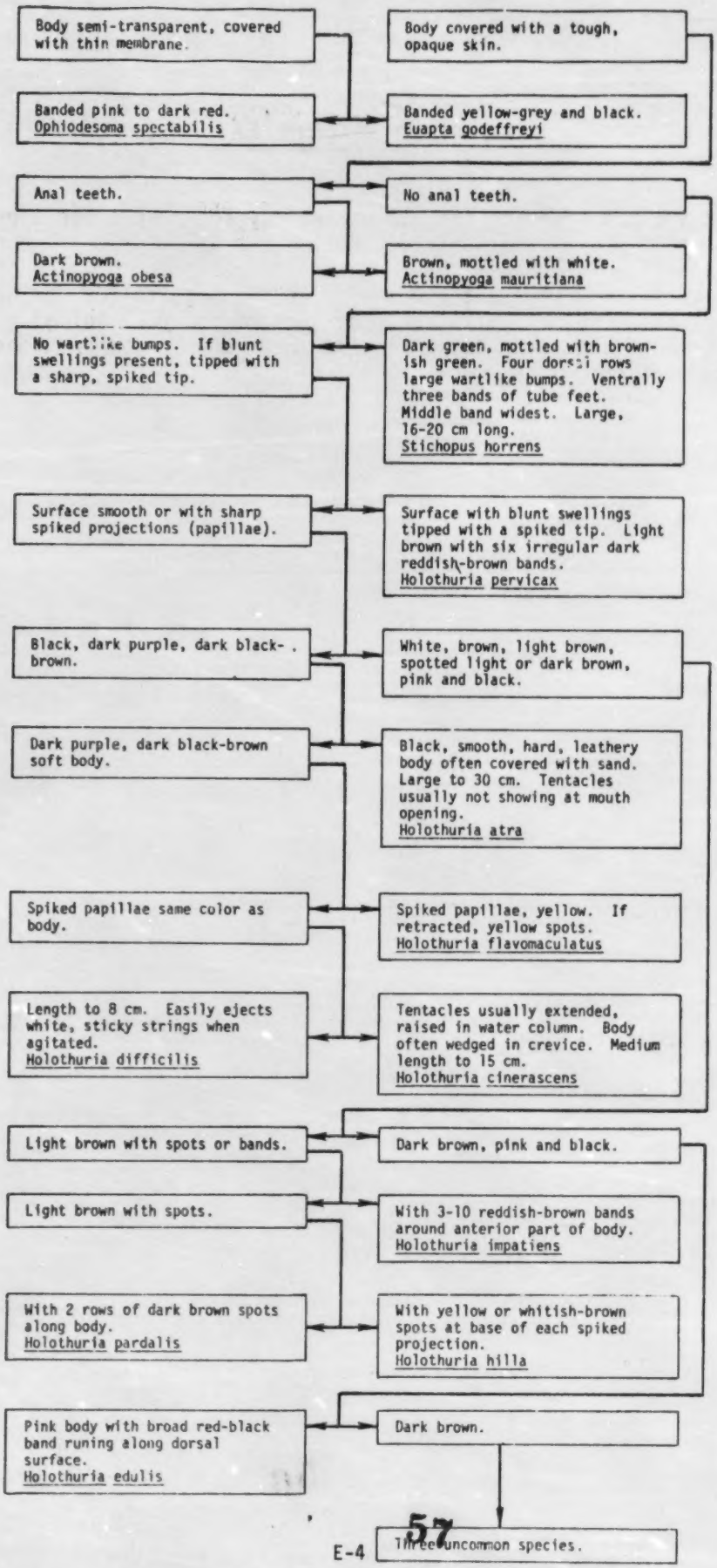
# COMMON
# SEA CUCUMBERS

## How to Use the Key

Look at the two boxes on the top of the key and make a decision as to which category fits your animal. Follow the arrow from the chosen box to the next set of boxes. Again make a decision as to which of the descriptions fits your sea cucumber. Continue to follow the arrows from the appropriate boxes until you reach a name for your animal. This name is underlined and is in Latin because there are no common names for most Hawaiian sea cucumbers.

# HOLOTHUROIDEA - SEA CUCUMBERS (FIELD KEY)


Body semi-transparent, covered with thin membrane.
Body covered with a tough, opaque skin.
Banded pink to dark red. Ophiodesoma spectabilis
Banded yellow-grey and black. Euapta godeffreyi
Anal teeth.
No anal teeth.
Dark brown. Actinopyoga obesa
Brown, mottled with white. Actinopyoga mauritiana
No wartlike bumps. If blunt swellings present, tipped with a sharp, spiked tip.
Dark green, mottled with brownish green. Four dorsal rows large wartlike bumps. Ventrally three bands of tube feet. Middle band widest. Large, 16-20 cm long. Stichopus horrens
Surface smooth or with sharp spiked projections (papillae).
Surface with blunt swellings tipped with a spiked tip. Light brown with six irregular dark reddish-brown bands. Holothuria pervicax
Black, dark purple, dark black-brown.
White, brown, light brown, spotted light or dark brown, pink and black.
Dark purple, dark black-brown soft body.
Black, smooth, hard, leathery body often covered with sand. Large to 30 cm. Tentacles usually not showing at mouth opening. Holothuria atra
Spiked papillae same color as body.
Spiked papillae, yellow. If retracted, yellow spots. Holothuria flavomaculatus
Length to 8 cm. Easily ejects white, sticky strings when agitated. Holothuria difficilis
Tentacles usually extended, raised in water column. Body often wedged in crevice. Medium length to 15 cm. Holothuria cinerascens
Light brown with spots or bands.
Dark brown, pink and black.
Light brown with spots.
With 3-10 reddish-brown bands around anterior part of body. Holothuria impatiens
With 2 rows of dark brown spots along body. Holothuria pardalis
With yellow or whitish-brown spots at base of each spiked projection. Holothuria hilla
Pink body with broad red-black band runing along dorsal surface. Holothuria edulis
Dark brown.
Three uncommon species.

## SUGGESTED READINGS


| | | |
|---|---|---|
| Arnold, A.F. | 1968 | The Sea-Beach at Ebb Tide. Dover Publications, Inc., New York. |
| Hobbson, E. and Chave E. | 1972 | Hawaii Reef Animals. The University Press of Hawaii. Honolulu, Hawaii. |
| Curriculum Research & Development Group Staff, University of Hawaii | 1976 | Reef and Shore. CRDG, University of Hawaii. Honolulu, Hawaii. |

# COMMON
# SHALLOW WATER
# URCHINS

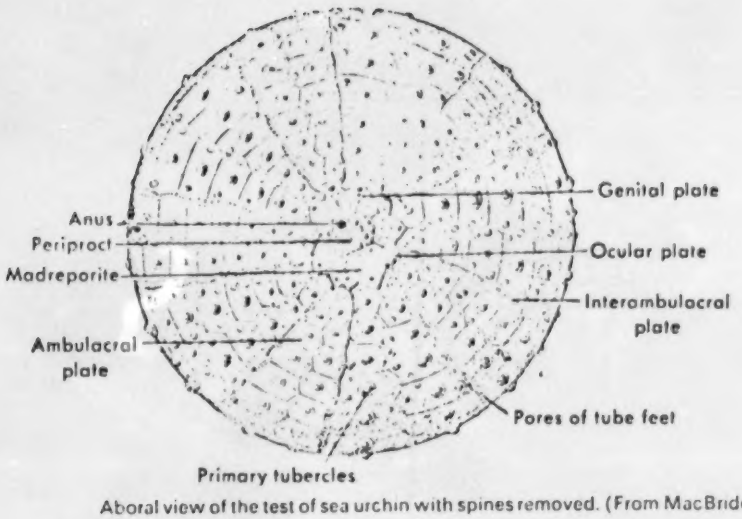
## How to Use the Key

A. Visually examine your specimen and familiarize yourself with its characteristics. Do not touch the specimen until you have identified it as some urchins can inflict painful injuries.

B. Match the characteristics of your specimen with the descriptions and pictures provided in the key. Note: Do not attempt to handle those urchines whose spines contain toxins.

## NOTE

## ANATOMY OF SEA URCHINS




Aboral view of the test of sea urchin with spines removed. (From MacBride.)

## SKELETON

The skeleton of the sea urchin is known as test, and is shown above. The apical system of plates contains the madreporite, four gential plates, with genital pores, and five ocular plates, each with a mass of pigmented cells. There are five pairs of columns of ambulacral plates. On the inside of the test around the peristome in many sea urchins are five arches, often incomplete, called auricles. Most of the plates bear spines, which are attached by muscles and move freely on little knob-like elevations called tubercles. The pedicellariae are more specialized than those of the starfish; they commonly have three jaws. The mouth is provided with five teeth; these are part of a complicated structure known as "Aristotle's lantern".

# CLASSIFICATION OF SHALLOW-WATER URCHINS

(Echinodermata; Echinoidea)

## SUBCLASS: REGULARIA

### FAMILY: CIDARIDAE -- (heavy primary spines and flat, secondary spines)

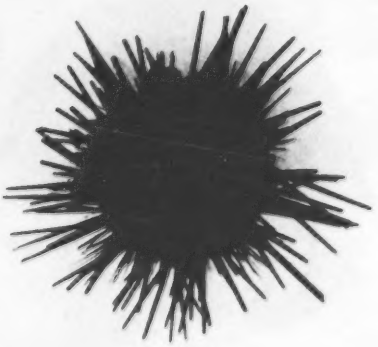
Eucidaris metularia

The test bears 10 vertical rows of heavy spines with bare furrows between them. Spines are thicker in the middle, blundtly rounded at tips. Fully grown specimens are about 1 inch in diameter, heavier spines are usually marked by alternating bands of red and pale yellow or white. They are found in both shallow and deep waters under rocks and in crevices.

### FAMILY: DIADEMATIDAE -- (long, slender, hollow primary spines and needle-like secondary spines contain painful toxin)

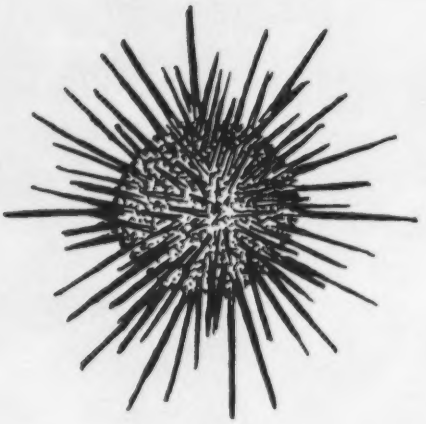
Diadema paucispinum

Primary spines are longer than the diameter of the test. These spines are hollow, and black in color in adult, reddish in young specimens, and unbanded. Fine delicate spines are interspersed among the longer ones. Found on the reefs, young specimens may be found in tidepools.



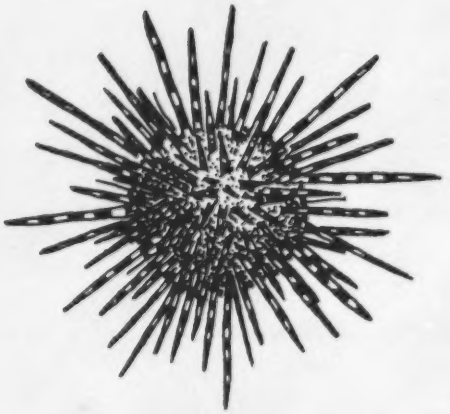
Echinothrix diadema

The spines, shorter than the diameter of the test when mature, are banded light and dark green in young specimens. Old specimens appear to be black. The spine is smooth when rubbed from tip to base.



Echinothrix calamaris

The spines, shorter than the diameter of the test when mature, are banded light and dark green, and the test is light green in young specimens. The spine has small spinelets making it impossible to rub from tip to base.



FAMILY: TOXOPNEUSTIDAE -- (numerous short to moderate-length spines)

Crytechinus verruculatus

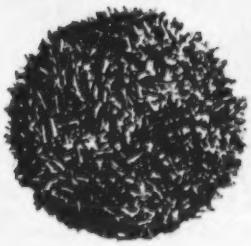
Densely covered with yellowish spines. When devoid of spines test shows greenish patches of color. Very active, often found buried in the gravel.

Tripneustes gratilla

Spines less than 1.2 cm long, densely cover shell and are purplish black. Test diameter may be greater than 1.2 cm. (Spines are often tipped with light brown.) Over-all shape of test is pentagonal. Quite common in shallow water of less than 2 meters. Often holding pebbles or debris on its aboral surface.

Pseudoboletia indiana

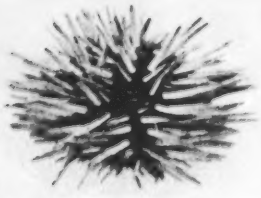
Symmetrical shell is densely covered with short, light purple spines (even lighter at tips) of very uniform length of about 1.5 cm long. The test diameter is often larger than 7 cm. Found at depths of 2 to 4 meters commonly buried under a thin layer of gravel.



FAMILY: ECHINOMETRIDAE -- (test border eliptical in outline)

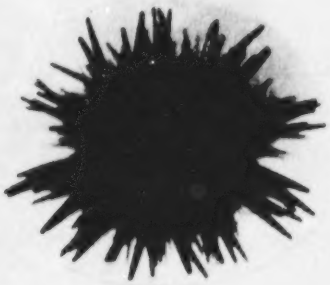
Echinometra mathaei

Most common shallow water sea urchin in Hawaii. Spines are about 2.5 cm long and are thick at the base and tapers to a sharp point. Large specimens are about 6 cm long at the greater diameter. Color ranges from green, gray or reddish brown. Found in crevices or under rocks.



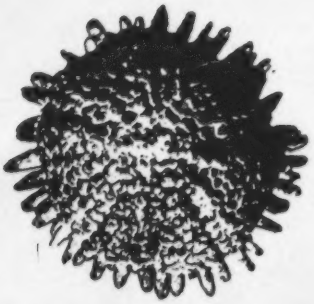
Echinometra oblonga

Closely related to E. mathaei, but has typically shorter, blunter, and thicker spines than those of E. mathaei. The color of the spine may either be dark purple or black.



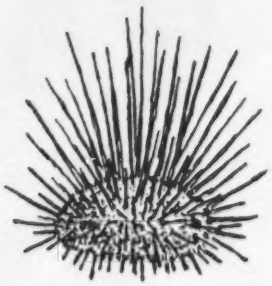
Colobocentrotus atratus

Short, flat, table-like spines cover the entire dome of the test, making a smooth surface. Longer, flattened spines with rounded tips form uneven rows about the margin. On the ventral surface are small spines and stout tube feet. The color of the dorsal and marginal spines is almost always purple; that of the ventral area, somewhat brown. This species is restricted to coastal areas on substrates directly exposed to wave action.



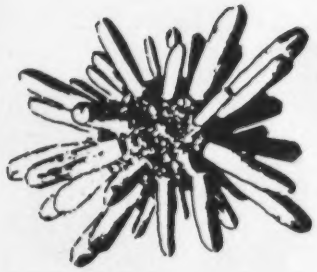
Echinostrephus aciculatus

Known as the "rock borer" and found in holes in shallow to deep water. The bronze spines on dorsal surface may be equal in length to the diameter of test while those on the ventral surface may be much shorter.



Heterocentrotus mammillatus

The "slate pencil" urchin is recognized by long, thick primary spines, which are triangular in cross section with blunt tips. Short, flat, red or white spines with expanded tips cover the test between the primary spines. Color of the primary spines ranges from yellowish and deep chocolate brown. In Hawaii most of the specimens are brick red.



## SUBCLASS: IRREGULARIA

### FAMILY: CLYPEASTERIDAE -- (flat, round test; cake urchin)

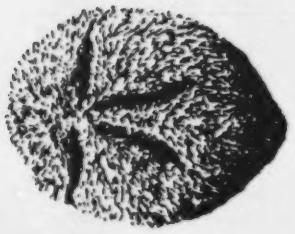
Clypeaster reticulatus

Shell is longer than broad with sides somewhat parallel. Five symmetrically arranged "etals" occupy the depressed area on the top portion of the test. Living specimens are densely covered with very short spines with test diameter of about 4 cm. They are usually found buried in sand at a depth of 4 to 6 meters.

## FAMILY: BRISSIDAE -- (oval test; heart urchin)

Brissus latecarinatus

Ventral surface is slightly convex with a crescent-shaped mouth near one end and a large anal opening close to the opposite margin. In live specimens the shell is covered with short, slender, light brown or green spines; usually found in the sand on the outer reef border in 2 to 4 meters of water.



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| Hiatt, R. | 1954 | Hawaiian Marine Invertebrates Unpublished syllabus |
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| Curriculum Research & Development Group Staff University of Hawaii | 1976 | Reef and Shore. Curriculum Research & Development Group, University of Hawaii. Honolulu, Hawaii. |

# COMMON TIDEPOOL FISHES

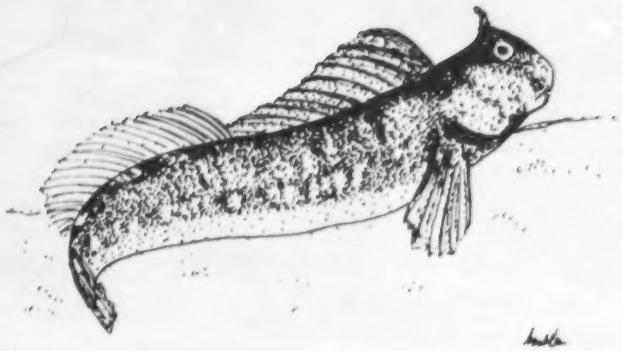
## How to Use the Key

A. Visually examine your specimen and familiarize yourself with its characteristics.

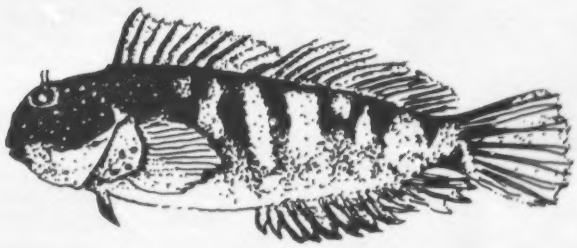
B. Match the characteristics of your specimen with the descriptions and pictures provided in the key.

# FISHES

## TIDEPOOL BLENNIES



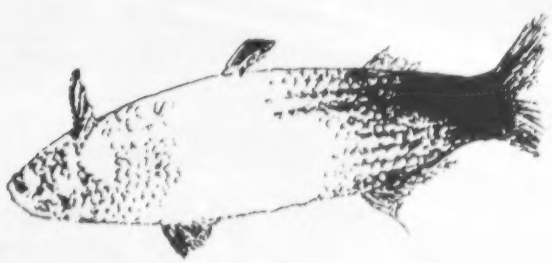
Istiblennius zebra, commonly called the rockskipper, is characterized by a fleshy flap located on the head behind the eye, and by its dusky black coloration. It is an extremely hardy fish, able to withstand extremes in both water conditions and temperature. Istiblennius gibbifrons differs from I. zebra in that it lacks the fleshy flap, and has a pronounced bulging of the forehead. Entomacrodus marmoratus, like I. zebra is found only in the Hawaiian Islands. It is greyish to green in color with distinct black markings along the dorsal surface and fins.



## REEF FLAT BLENNIES

Inhabiting many of the reef flat areas in the islands are blennies of the genus Cirripectes. Of these, C. variolosus is probably most common. Extremely dark in color, this blenny can be found in nearly any area of shallow to moderate depth. C. obscurus is the largest of the local blennies, attaining a length of 16 cm. The male differs from the female by being pinkish in color as opposed to yellow-brown. C. lineopunctatus prefers strong surge and is common along rocky shores. It can be distinguished from other Cirripectes by an unbranched tentacle over each eye.

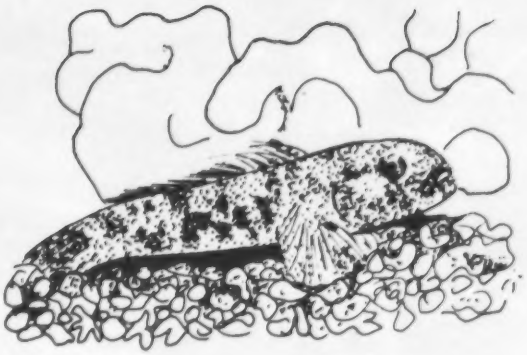
## MULLETS

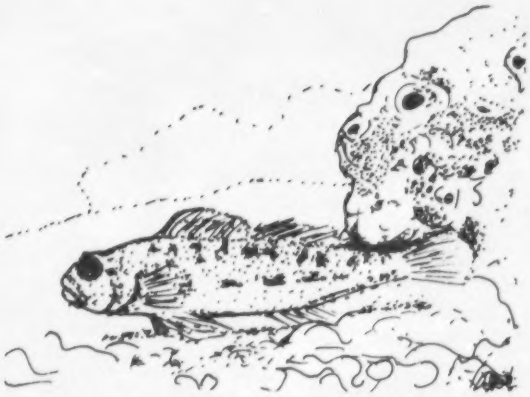


Juvenile mullets, Neomyxus chaptalii, are fairly common to tidepools along rocky coasts. Their striking silver color and blunt bullet-shaped heads make them easy to spot as they swim in schools against the surge. Another mullet, Mugil cephalus, may be found along open coasts but seems to prefer brackish water and is cultured in ponds.

## TIDEPOOL GOBIES

Two tidepool gobies of the genus Bathygobius are common to Hawaii. B. cotticeps differs from B. fuscus in that its head is flattened as opposed to the rounded head of B. fuscus. Coloration in these gobies ranges from a grainy sand-like color to dark grey.



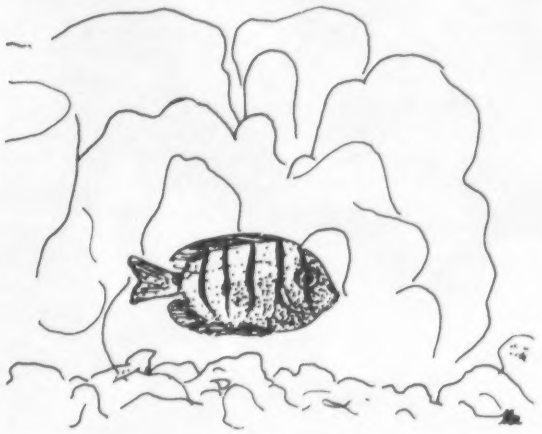


## REEF FLAT AND SAND GOBIES

Along reef flats, gobies are abundant. Gnatholepts anjerensis, the only goby with a dark band extending down from the eye, can usually be found along the sandy bottom near coral heads. Asterropteryx semipunctatus is found in holes. Females are sandy in color and males are black with blue spots. A third goby, Psilogobius mainlandi, may be seen on the sand at the entrance to snapping shrimp burrows. It is sandy in color.

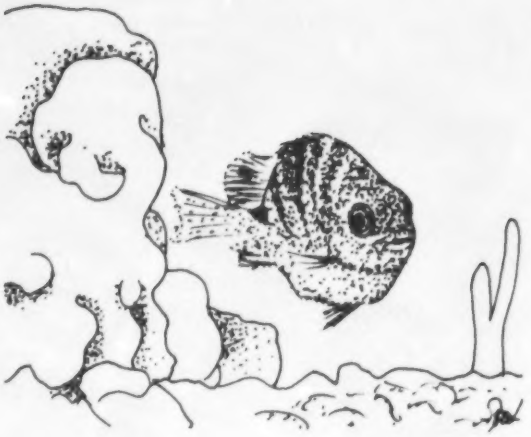
## SURGEONFISHES

Many juvenile surgeonfishes may be encountered in tidepools open to surge, but perhaps the most commonly observed species is the Acanthurus triostegus, (Manini). This species is distinguished by its greyish color and black vertical stripes. Unlike other members of this family of fish, the Manini has a minute, nearly transparent "knife" at its caudal base.



## DAMSELFISHES

Two extremely common tidepool inhabitants called damselfishes are characterized by being deep-bodied. Abudefduf sordidus, the Kupipi, possesses a black spot on its caudal peduncle and a greyish-green body. A larger black blotch fringed with yellow on its dorsal fin can be seen.

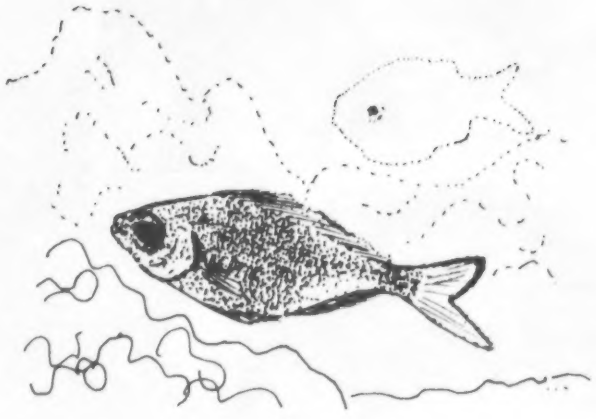


## MAOMAO

The Maomao, Abudefduf abdominalis, differs from A. sordidus in that it lacks the black spot and its bars are prominent. Colors are yellow and black.

## SILVER PERCH

The Aholehole, Kuhlia sandvicensis, is common in all types of tidepools, those with both rocky and sandy bottoms. It seems to prefer areas of high surge and is a very hardy fish. The striking silver color and large eyes are characteristic.



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